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URGENT – RESPONSE DUE TODAY

Dear Sirs

Re: PCT Patent Application No. PCT/GB2003/003145
Council for the Central Laboratory of the Research Councils
Our Ref: MH/RB/LH/P089166PWO

We write in response to the Written Opinion dated 16 March 2004, the deadline for responding being 16 August 2004.

We enclose new claims 1 to 20 to replace previous claims 1 to 20.

New claim 1 has been amended in response to the clarity objection raised by the Examiner.

The Examiner argues that the term "light selection means" has no well-defined, generally accepted meaning. We believe that its meaning is made clear when read in context with the remainder of claim 1. Nevertheless, we have amended claim 1 to further clarify the meaning of this term and to highlight the invention.

Specifically, claim 1 has been amended to specify that "the first and second light selection means are operable simultaneously such that when the first light selection means is adjusted to pass light to the detector, the second light selection means is adjusted to prevent passage of any light to the detector, and vice versa". The inclusion of the word "any" clarifies that only transmitted or scattered/fluoresced light is detected at any one time.

Referring to the cited prior art, GB-A-2212261 (D1) is directed towards measuring the contamination level in a fluid. This is achieved by detecting the light scattered by and transmitted through the liquid of interest. Detection is achieved by the use of wavelength selective filters and corresponding optical fibres, which are used to collect light substantially in-line with the input light and at an angle to the input light.

In all embodiments described in D1, light filtered by the respective wavelength selective filters (or, as the case may be, the graded optical filter) is transmitted to a single optical fibre,

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where it is then multiplexed and passed to a detector. It will be appreciated that in order to extract any meaningful information from the multiplexed signal, complex de-convolution algorithms/procedures may be required at the detection stage.

The present invention avoids these problems by providing apparatus with means for "selecting" the light to be detected (specifically either transmitted or scattered/fluoresced light, corresponding to light substantially parallel to the incident light and light substantially transverse to the detected light, respectively). Thus, for example, for a period of time "x" transmitted light may be allowed to pass to the detector, whereas scattered/fluoresced is prevented from passing to the detector. Thus in this case, only transmitted light is detected. In a second mode, transmitted light is prevented from passing to the detector, whereas scattered/fluoresced light is allowed to pass to the detector. Thus, only scattered/fluoresced light is detected. Such selection of light is affected by the use of "light selection means", the operation of which is clarified by the amendment made to claim 1.

D1 discloses no such light selection means, only passive wavelength selective filters. The present invention can undertake the measurements made by D1, but by providing light selection means, does not require the complex multiplexing and demultiplexing procedures required to gather and extract information about a sample in question, while also using only a single detector. D1 neither discloses nor teaches towards such apparatus.

Although true simultaneous measurement of transmitted and scattered/fluoresced light is not possible with the present invention, the light selection means can be operated at such speeds so as to achieve a virtual simultaneous measurement. Again, no complex de-convolution procedures are required to extract the information. All that is required is the knowledge of when transmitted and scattered/fluoresced light is passed to the detector (such that it is known whether detected light is, respectively, transmitted or scattered/fluoresced).

It will be appreciated that while the present invention can perform the same measurements as that of D1, it can also perform many more. As a simple example, the present invention can be used to detect only transmitted or scattered/fluoresced light. Due to the simple use of "light selection means", the present invention is a much simpler device than that of D1, and is also more versatile.

Thus, we respectfully submit to the Examiner that the present invention is both novel and comprises an inventive step.

Referring now to the dependent claims, new claims 2 to 6 correspond to previous claims 2 to 6, but the dependency of claim 5 has been corrected in accordance with the Examiner's suggestion in sub-section 1c of the "Further Remarks" section of the Written Opinion. Specifically, claim 5 is now correctly dependent from claim 3.

New claims 7 to 10 correspond to previous claims 7 to 10, but the dependency of claim 7 has been amended. Specifically, claim 7 is now dependent from any one of claims 2 to 6. This amendment simplifies the dependencies of new claim 11. A new claim has been added (new claim 19), corresponding to previous claim 7, but dependent only on claim 1.

Previous claim 11 has been deleted.

New claim 11 corresponds generally to previous claim 12, but has been amended to overcome the clarity objection raised by the Examiner. Firstly, its dependencies have been corrected such that it depends on any one of claims 8 to 10. This amendment has been simplified by the aforementioned amendment to claim 7. Furthermore, the claim has been amended to specify the effects of the first and second positions of the shutter and the light guide shutters respectively, basis for which can be found in the description of the present application. Specifically, the claim has been amended to specify that as the shutter is moved from the first position to the second position, light substantially parallel to the incident light is prevented from passing to the detector, whereas, at the same time, the light guide shutters move from their second position to their first position, thereby allowing light substantially transverse to the incident light to pass to the detector, and vice versa. As the Examiner will appreciate from the amendment to claim 1, this is merely a reiteration of the effects of the light selection means (which may be shutters and/or light guide shutters) – i.e. transmitted or scattered/fluoresced light is not detected simultaneously.

New claims 12 to 18 correspond to previous claims 13 to 19, but new claim 14 (corresponding to previous claim 15) has had its dependencies corrected in accordance with the Examiner's suggestion in sub-section 1c in the "Further Remarks" section of the Written Opinion". Specifically, new claim 14 is now dependent on claim 13 (old claim 14) when dependent on claim 11 (old claim 12).

New claim 19 corresponds to previous claim 7, but is dependent only on claim 1. This is to ensure that the applicant loses no scope of protection as a consequence of the amendment to claim 7.

New claim 20 corresponds to previous claim 20.

No other changes have been made.

The Examiner has also requested the amendment of the description in sub-section 2 of the "Further Remarks" section of the Written Opinion. We propose to make the consequential and necessary amendments to the description when this PCT application enters that National Phase. We can then ensure that the description conforms to the requirements of each respective National Patent Office. We trust that this is an acceptable approach to take.

We now believe that the present claim set is both novel and inventive over the prior art.

Yours faithfully

MATTHEW HOLMES
MARKS & CLERK

CLAIMS

1. An optical apparatus comprising a sample holding means, a detector and first and second light selection means, the sample holding means being arranged to receive incident light from a light source, the first light selection means being arranged to selectively allow light that passes from the sample holding means in a direction substantially parallel to the direction of the incident light to pass to the detector, and the second light selection means being arranged to selectively allow light that is emitted from the sample holding means in a direction substantially transverse to the direction of the incident light to pass to the detector, wherein the first and second light selection means are operable simultaneously such that when the first light selection means is adjusted to pass light to the detector, the second light selection means is adjusted to prevent passage of any light to the detector, and vice versa.
2. An optical apparatus according to claim 1, wherein the first light selection means comprises a shutter located between the sample holding means and the detector, the shutter being moveable between a first position in which the light that is substantially parallel to the incident light passes through the shutter to the detector, and a second position in which the light that is substantially parallel to the incident light is prevented from passing to the detector.
3. An optical apparatus according to claim 2, wherein the shutter is provided with a reflective surface arranged such that when the shutter is in the second position the light that is substantially parallel to the incident light is reflected from the shutter.
4. An optical apparatus according to claim 3, wherein the shutter is arranged to reflect the light back into the sample holder.
5. An optical apparatus according to claim 3, wherein the shutter is arranged to reflect the light to a second detector or to a light trap.

6. An optical apparatus according to claims 4 and 5, wherein the reflective surface of the shutter is moveable and may be adjusted to either reflect the light back into the sample holder, or to reflect the light to the second detector or to the light trap.
7. An optical apparatus according to any one of claims 2 to 6, wherein the second light selection means comprises one or more light guides.
8. An optical apparatus according to claim 7, wherein the one or more light guides are provided with light guide shutters moveable from a first configuration in which light is allowed to enter the one or more light guides, and a second configuration in which light is substantially prevented from entering the one or more light guides.
9. An optical apparatus according to claim 8, wherein the one or more light guides comprise one or more pentaprisms.
10. An optical apparatus according to claim 8, wherein the one or more light guides comprise one or more fibre optic cables.
11. An optical apparatus according to any one of claims 8 to 10, wherein the shutter and the light guide shutters are provided with operation means which allow them to be operated simultaneously, such that as the shutter is moved from a first position to a second position, thereby preventing light substantially parallel to the incident light from passing to the detector, the light guide shutters move from their second position to their first position, thereby allowing light substantially transverse to the incident light to pass to the detector, and vice versa.
12. An optical apparatus according to claim 11, wherein the operation means comprises a mechanical connection.
13. An optical apparatus according to any preceding claim, wherein the apparatus is provided with one or more wavelength dependent optical filters which may be used

to selectively transmit to the detector light at the wavelength of the incident light or light at a fluorescence wavelength.

14. An optical apparatus according to claim 13 when dependent on claim 11, wherein the one or more wavelength dependent optical filters are mounted in a holder which may be connected to the operation means, such that movement of the shutter and the light guide shutters also moves the holder, thereby positioning an appropriate wavelength dependent optical filter over the detector.

15. An optical apparatus according to claim 14, wherein the holder is provided with an opening which does not contain a wavelength dependent optical filter.

16. An optical apparatus according to any preceding claim, wherein the detector is a photo-multiplier tube.

17. An optical apparatus according to any preceding claim, wherein the sample holding means comprises a housing dimensioned to receive a cuvette.

18. An optical apparatus according to claim 17, wherein areas of upper and lower surfaces of the housing are opaque such that light travelling in a direction which is not substantially parallel to the direction of the incident light is prevented from passing via the first light selection means to the detector.

19. An optical apparatus according to claim 1, wherein the second light selection means comprises one or more light guides.

20. An optical apparatus substantially as hereinbefore described with reference to the accompanying drawings.